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CONVERSION OF THERMAL ENERGY OF A HEATER INTO COHERENT MICROWAVE RADIATION IN A PARAMAGNETIC CRYSTAL.

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Abstract

The first experimental investigation of transient conversion of thermal energy of an external source (metal resistance heater) into the energy of weak electromagnetic oscillations of 9. 1 GHz frequency was carried out by an ESR method at helium-II temperatures on a ruby crystal (3 multiplied by 4 multiplied by 4 mm) containing 0. 014 at. % of chromium. The effect was observed as a result of the m//s equals plus 3/2 B ARR LR m//s equals plus 1/2 transition between the spin energy levels of the Cr**3** plus ions in a magnetic field H equals 7. 39 kOe directed along the optic axis of a crystal. The kinetic ESR signals were recorded as a function of the energy E of the heating pulses. For E equals 48 mJ the maximum value of the population inversion coefficient was 2. 7, the inversion lifetime was about 0. 8 sec, and the conversion efficiency was eta approximately equals 10** minus **5. The results were analyzed on the basis of a simple thermal model allowing for a vapor-liquid helium film at the boundary. The main physical features of such thermally excited lasers were identified and some ways of improving them were considered.